

Chemistry I: Gas Law Problems

1. A gas occupies 12.3 liters at a pressure of 40.0 mmHg. If the temperature remains constant, what is the new volume when the pressure is increased to 60.0 mmHg?
2. If a gas at 25.0 °C occupies 3.60 liters at a pressure of 1.00 atm, what will be its volume at a pressure of 50 atm and the temperature remains the same?
3. To what pressure must a gas that occupies 400.0 cu. ft. at standard pressure be compressed to fit into a 3.00 cubic foot tank? The temperature remains the same.
4. A gas occupies 1.56 L at 1.00 atm. What will be the volume of this gas if the pressure becomes 3.0 atm with the temperature remaining the same?
5. A gas occupies 11.2 liters at 0.860 atm. With the temperature constant, what is the pressure if the volume becomes 15.0 L?
6. 500.0 mL of a gas is collected at 745.0 mmHg. What will the volume be at standard pressure? $T_1 = T_2$ are equal.
7. Convert 350.0 mL at 740.0 mm of Hg to its new volume at standard pressure with the temperature constant.
8. Convert 3.38 L at 63.0 atm to its new volume at standard pressure with the temperature constant.
9. Convert 273.15 mL at 166.0 mm of Hg to its new volume at standard pressure with the temperature constant.
10. Convert 77.0 L at 18.0 mm of Hg to its new volume at standard pressure with the temperature constant.
11. Calculate the decrease in temperature (in Kelvin) when 2.00 L at 20.0 °C is compressed to 1.00 L with pressure remaining the same.
12. A gas occupies 900.0 mL at a temperature of 27.0 °C. Under constant pressure, what is the volume at 132.0 °C?
13. What change in volume results if 60.0 mL of gas is cooled from 33.0 °C to 5.00 °C while pressure is held constant?
14. Given 300.0 mL of a gas at 17.0 °C. What is the new volume at 10.0 °C? Pressure remains constant.
15. A gas occupies 1.00 L at standard temperature and pressure. What is the volume at 333.0 °C and standard pressure?

16. At 27.00 °C a gas has a volume of 6.00 L and 1 atm. What will the volume be at 150.0 °C and 1 atm?
17. At 225.0 °C a gas has a volume of 400.0 mL. What is the volume of this gas at 127.0 °C? Pressure remains constant.
18. At 210.0 °C and 2 atm pressure, a gas has a volume of 8.00 L. What is the volume of this gas at -23.0 °C and 2 atm?
19. The temperature of a 4.00 L sample of gas is changed from 10.0 °C to 20.0 °C. What will the volume of this gas be at the new temperature if the pressure is held constant?
20. Carbon dioxide is usually formed when gasoline is burned. If 30.0 L of CO₂ is produced at a temperature of 1.00 X10³ °C and allowed to reach room temperature (25.0 °C) without any pressure changes, what is the new volume of the carbon dioxide?
21. A 600.0 mL sample of nitrogen is warmed from 77.0 °C to 86.0 °C. Find its new volume when the pressure remains constant.
22. What volume change occurs to a 400.0 mL gas sample as the temperature increases from 22.0 °C to 30.0 °C and constant pressure?
23. A gas syringe contains 56.05 milliliters of a gas at 315.1 K. Determine the volume that the gas will occupy if the temperature is increased to 380.5 K and no change in pressure has occurred?
24. A gas syringe contains 42.3 milliliters of a gas at 98.15 °C. With pressure remaining constant, determine the volume that the gas will occupy if the temperature is decreased to -18.50 °C.
25. A gas has a volume of 800.0 mL at -23.00 °C and 300.0 torr. What would the volume of the gas be at 227.0 °C and 600.0 torr of pressure?
26. 500.0 liters of a gas are prepared at 700.0 mmHg and 200.0 °C. The gas is placed into a tank under high pressure. When the tank cools to 20.0 °C, the pressure of the gas is 30.0 atm. What is the volume of the gas?
27. What is the final volume of a 400.0 mL gas sample that is subjected to a temperature change from 22.0 °C to 30.0 °C and a pressure change from 760.0 mmHg to 360.0 mmHg?
28. What is the volume of gas at 2.0 atm and 200.0 K if its original volume was 300.0 L at 0.250 atm and 400.0 K?
29. At conditions of 785.0 torr of pressure and 15.0 °C temperature, a gas occupies a volume of 45.5 mL. What will be the volume of the same gas at 745.0 torr and 30.0 °C?

30. A gas occupies a volume of 34.2 mL at a temperature of 15.0 °C and a pressure of 800.0 torr. What will be the volume of this gas at standard conditions?
31. The volume of a gas originally at standard temperature and pressure was recorded as 488.8 mL. What volume would the same gas occupy when subjected to a pressure of 100.0 atm and temperature of -245.0 °C?
32. At a pressure of 780.0 mmHg and 24.2 °C, a certain gas has a volume of 350.0 mL. What will be the volume of this gas under STP?
33. A gas sample occupies 3.25 liters at 24.5 °C and 1825 mmHg. Determine the temperature at which the gas will occupy 4250 mL at 1.5 atm.
34. If 10.0 liters of oxygen at STP are heated to 512 °C, what will be the new volume of gas if the pressure is also increased to 1520.0 mm of mercury?
35. What is the volume at STP of 720.0 mL of a gas collected at 20.0 °C and 3.00 atm pressure?
36. 2.00 liters of hydrogen, originally at 25.0 °C and 750.0 mm of mercury, are heated until a volume of 20.0 liters and a pressure of 3.50 atmospheres is reached. What is the new temperature?
37. A gas balloon has a volume of 106.0 liters when the temperature is 45.0 °C and the pressure is 740.0 mm of mercury. What will its volume be at 20.0 °C and 780.0 mm of mercury pressure?
38. A 73.0 mL sample of nitrogen at STP is heated to 80.0 °C and the volume increases to 4.53 L. What is the new pressure?
39. 500.0 mL of a gas was collected at 20.0 °C and 720.0 mmHg. What is its volume at STP?
40. A sample of gas occupies 50.0 L at 15 °C and 640 mmHg pressure. What is the volume at STP?
41. A gas is heated from 263.0 K to 298.0 K and the volume is increased from 24.0 liters to 35.0 liters by moving a large piston within a cylinder. If the original pressure was 1.00 atm, what would the final pressure be?
42. The pressure of a gas is reduced from 1200.0 mmHg to 850.0 mmHg as the volume of its container increases by a moving piston from 85.0 mL to 350.0 mL. What would the final temperature be if the original temperature were 90.0 °C?
43. If a gas is heated from 298.0 K to 398.0 K and the pressure is increased from 2.230×10^3 mmHg to 4.560×10^3 mmHg, what final volume would result if the volume were allowed to change from an initial volume of 60.0 liters?

Combined Gas Law (requires Dalton's Law also)

IMPORTANT NOTE: A gas collected over water is always considered to be saturated with water vapor. The vapor pressure of water varies with temperature and **must be looked up in a reference source**.

44. 690.0 mL of oxygen are collected over water at 26.0 °C and a total pressure of 725.0 mm of mercury. What is the volume of dry oxygen at 52.0 °C and 800.0 mm pressure?
45. 400.0 mL of hydrogen are collected over water at 18.0 °C and a total pressure of 740.0 mm of mercury. Correct the volume to STP.
46. A 45.0 mL sample of argon gas is collected over water at 729.3 mmHg and 25.0 °C. What would be the volume of this dry gas at standard conditions?
47. A 19.1 L sample of He gas is collected over water at 681.3 mmHg and 18.5 °C. What would be the volume of this dry gas at standard conditions?
48. 407 mL of H₂ gas is collected over water at 785.3 mmHg and 23.5 °C. What would be the volume of this dry gas at standard conditions?

Ideal Gas Law

49. How many moles of gas are contained in 890.0 mL at 22° C and 750.0-mmHg pressure?
50. A 1.09 g sample of H₂ is contained in a 2.00 L container at 20.0 °C. What is the pressure in this container in mmHg?
51. Calculate the volume 3.00 moles of a gas will occupy at 24.0 °C and 762.4 mmHg.
52. How many moles of a gas would be present in a gas trapped within a 37.0 liter vessel at 80.00 °C at a pressure of 2.50 atm?
53. What volume will 1.27 moles of helium gas occupy at STP?
54. At what temperature will 0.654 moles of neon gas occupy 12.30 liters at 1.95 atmospheres?
55. A 30.6 g sample of gas occupies 22.4 L at STP. What is the molecular weight of this gas?
56. A 40.0 g gas sample occupies 11.2 L at STP. Find the molecular weight of this gas.
57. A 12.0 g sample of gas occupies 19.2 L at STP. What is the molecular weight of this gas?
58. A 96.0 g sample of a gas occupies 48.0 L at 700.0 mmHg and 20.0 °C. What is its molecular weight?

59. At STP 3.00 liters of an unknown gas has a mass of 9.50 grams. Calculate its molar mass.
60. At STP 150.0 mL of an unknown gas has a mass of 0.250 gram. Calculate its molar mass.
61. A 1.089 g sample of a gas occupies 4.50 L at 20.5 °C and 0.890 atm. What is its molar mass?
62. A 0.190 g sample of a gas occupies 250.0 mL at STP. What is its molar mass? What gas is it? Hint -calculate molar mass of the gas.
63. If 9.006 grams of a gas are enclosed in a 50.00 liter vessel at 273.15 K and 2.000 atmospheres of pressure, what is the molar mass of the gas? What gas is this?